ZA00J
Miscellaneous Grant Programs

High Performance Data Center (Baltimore City)

General Obligation Bonds **$12,000,000**

Summary of Recommended Bond Actions

1. High Performance Data Center

   Approve the general obligation bonds for $12 million for the High Performance Data Center.

2. Section 12 – Miscellaneous – High Performance Computing Data Center

   Approve the pre-authorization of general obligation bonds for $15 million for the High Performance Data Center.

Project Analysis

The High Performance Data Center (HPDC) is a 13,250 gross square foot facility to house modular high performance data storage and computer servers for researchers at The Johns Hopkins University (JHU) and the University of Maryland College Park (UMCP). Over the past decade, unprecedented advances in high performance computing have created a vast amount of data, across numerous academic disciplines. JHU and UMCP believe that a focused investment in a specialized facility will enable the schools to secure federal grants and retain critical faculty in emerging fields of study, such as computational genomics.

HPDC will also enable Maryland to provide national leadership in the growing field of "Big Data" science through research at JHU and UMCP. The computing services available from HPDC will also assist the State's growing private biotechnology sector, which frequently needs high performance computers for private research. The institutions believe the scientific and economic development created by HPDC will create a valuable synergy between UMCP, JHU, and the private sector at a crucial time when technology transfer has become a focus for the State's workforce and economic development.

No existing facility at either campus met the specifications for this type of facility, so HPDC will be built on land owned by JHU adjacent to JHU's Bayview Medical Campus in East Baltimore. This site was selected due to its proximity to large, reliable power sources and the existing high bandwidth networks in Baltimore City, which make transferring data more reliable and secure. The facility will be jointly operated and used by both JHU and UMCP.

While HPDC was not in the 2012 session *Capital Improvement Program*, the fiscal 2013 budget provided $3.0 million that, along with $2.93 million in JHU funds, were used for acquisition, planning, construction, and equipment. The fiscal 2014 budget provides $8.0 million to begin construction and $4.0 million for equipment. The 2013 session capital budget bill provides a pre-authorization for the 2014 session for the remaining $15.0 million estimated to be needed to fully fund construction and equipment costs.

Of the $27 million in total State funds for this project in fiscal 2014 and 2015, $12 million is for equipment. This includes numerous computer servers which are both very expensive and have a limited lifespan due to rapidly changing computer technology. JHU reports that equipment purchasing will be done as late as possible to ensure the most up-to-date information technology (IT) is purchased. In total, the State is programmed to contribute $30.0 million, or 91.1% of total funding for HPDC, while JHU will contribute a total of $2.93 million, or 8.9%. It is expected that the capital investment will actually be smaller than the operating costs of HPDC over its lifetime.

As utilities are one of the greatest costs to running a data center, HPDC will use the latest technology to be power efficient. This is measured by the power usage effectiveness (PUE) which is the total facility power divided by IT equipment power. While an existing JHU data center has a PUE of 2.7, HPDC is expected to have a PUE of only 1.3, a large improvement in energy efficiency as more power is used to process data rather than keep the computer servers cool. Current plans have the facility completed in December 2014, and the facility will be fully operational and in use at the beginning of calendar 2015. The expected minimum lifespan of the facility is 15 years due to new advancements in power distribution and cooling rather than the physical deterioration of the plant itself.

Scalability

The current State funding builds a facility that would consume about two megawatts of power when running at full capacity, but the modular design of the facility would allow future expansion of up to eight megawatts of total power consumption. This means the initial State investment is being partially used to prepare the site and first phase of the facility for later expansion. Currently, no State funds are programmed for future expansion of HPDC, and JHU has no expectations for State support in the future. Instead, JHU believes that other sources, including philanthropy or private investors, may be available to expand the computing capacity at HPDC.

Big Data and State Investment

With the spread of IT, data collection has increased rapidly. This "Big Data" wave has required research institutions to rethink how information is collected, stored, and analyzed. In the past, piecemeal networks spread across campus sufficed to attract grants and get work done. However, today this prevents the sharing of data and collaboration on large-scale projects.

Other states, such as Massachusetts and New York, recently launched large data center projects to take advantage of the emerging Big Data industry. JHU and UMCP believe HPDC will serve as Maryland's anchor in this growing area of research and will thus help create and retain high paying technology jobs in the State. A previous $1.2 million National Science Foundation grant enabled JHU and UMCP to build an optical fiber network connecting the Baltimore metro area to the Washington capital region. This high speed connection means UMCP researchers can access HPDC remotely and securely.

Fields of study that are increasingly reliant on data center resources include genomics, nanoscale fabrication, and molecular chemistry. JHU and UMCP have identified about 200 faculty that would immediately use HPDC. Additionally, the private sector in Maryland, such as biotechnology firms, would likely find the ability to purchase HPDC computer time – a valuable resource. Both campuses report that HPDC will assist in technology transfer and entrepreneurialism, which are critical components for the State's business growth goals.

A Public-Nonprofit Partnership

JHU and UMCP have proposed a memorandum of understanding (MOU) that covers the administration and operations of HPDC. The two institutions will have equal rights of access to HPDC and to the resources available. The MOU is in force for five years and can be renewed for one-year extensions afterward.

The management committee established by the MOU will determine appropriate "methodology and procedures for each Party's contribution to the annual operating budget based upon usage." Currently, JHU estimates that the annual operating cost of HPDC will be between $4 million and $5 million, which includes 3 to 4 staff, maintenance, and utilities.

According to the MOU, UMCP is obligated to pay for at least 15% of the operating costs per year to retain voting rights in the administrative committee that runs HPDC. This would amount to at least $3 million over the first five years of the MOU. Currently, operational costs for leased computer space are not an allowable expense for many federal grants, but locally owned hardware is.

UMCP should comment on whether additional State funds will be requested to cover its share of HPDC operating costs or whether this may be covered by overhead allowances within research grants.

Finally, although not mentioned directly in the MOU, it is the goal of this State-funded capital project for the computational power available at HPDC to be made available to other public four-year

institutions in Maryland. In particular, the University of Maryland, Baltimore; Morgan State University; and the University of Maryland Baltimore County are all classified as high activity research universities that may find HPDC useful. The MOU allows for each of the founding partners to open access to HPDC to other external parties with consent of the management committee.

UMCP and JHU should comment on the timeline for establishing how other Maryland universities can gain access to HPDC.

Prior Authorization and Capital Improvement Program

Authorization Uses
($ in Millions)

Fund Uses	*Prior Authorization*	*2014 Request*	*2015 Estimate*	*2016 Estimate*	*2017 Estimate*	*2018 Estimate*
Acquisition	$2.500	$0.000	$0.000	$0.000	$0.000	$0.000
Planning	0.564	0.000	0.000	0.000	0.000	0.000
Construction	2.436	8.000	7.000	0.000	0.000	0.000
Equipment	0.433	4.000	8.000	0.000	0.000	0.000
Total	**$5.933**	**$12.000**	**$15.000**	**$0.000**	**$0.000**	**$0.000**

Authorization Sources
($ in Millions)

Fund Uses	*Prior Authorization*	*2014 Request*	*2015 Estimate*	*2016 Estimate*	*2017 Estimate*	*2018 Estimate*
GO Bonds	$3.000	$12.000	$15.000	$0.000	$0.000	$0.000
Nonbudgeted	2.933	0.000	0.000	0.000	0.000	0.000
Total	**$5.933**	**$12.000**	**$15.000**	**$0.000**	**$0.000**	**$0.000**

GO Bond Recommended Actions

1. Approve the general obligation bonds for $12 million for the High Performance Data Center (HPDC). This will fund a new data center at The Johns Hopkins University in Baltimore that will be jointly operated with the University of Maryland, College Park for intensive computational research.

2. Approve the preauthorization of general obligation bonds for $15 million for the High Performance Data Center. This will continue State funding for the program into fiscal 2015 for construction and equipment. With this preauthorization, total State funding is programmed for $30 million from fiscal 2013 to 2015.